East West University

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Name: Bijoy Basak

ID No: 2018-2-60-033

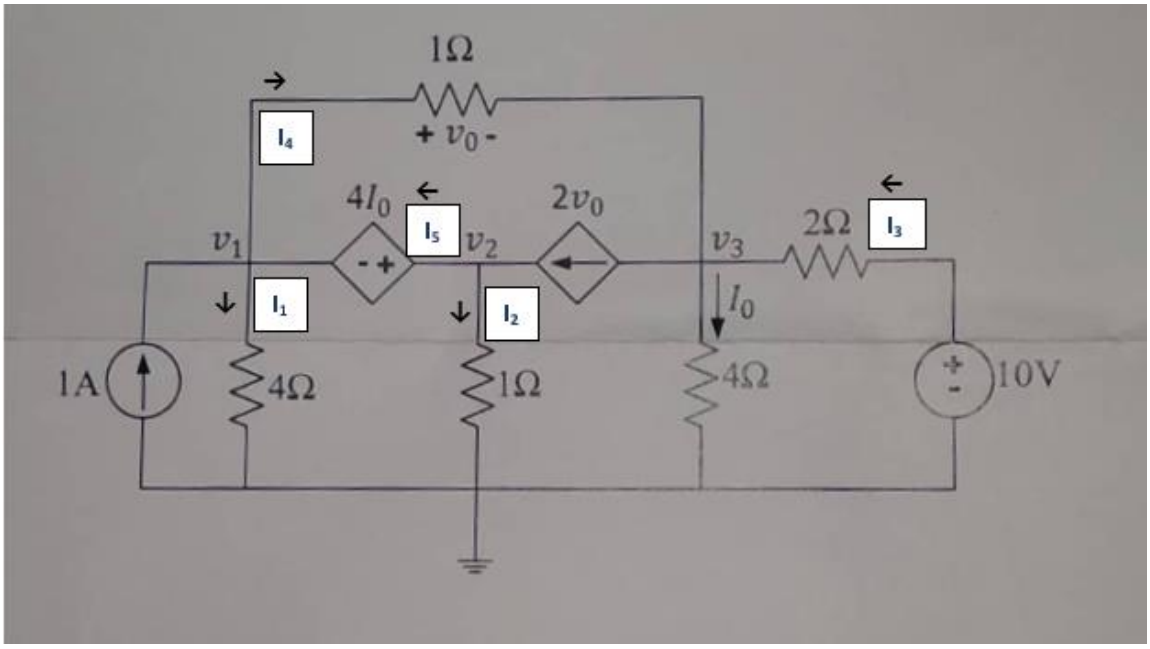
Section: 02

Course Instructor: M Saddam Hossain Khan

Course Title: Electrical Circuits

Course Code: CSE209

Circuit Diagram



1.Theoretical Analysis

Using nodal analysis to solve this DC circuit.

There is a supernode in node 1 and 2 .

Equation for the current controlled voltage source insidethe supernode,

VS : V_2-V_1 = 4I_0 ; Here , $I_0 = \frac{V3}{4}$

⇨ $V_2 - V_1 = 4 \times \frac{V3}{4}$

⇨ $V_1 - V_2 + V_3 = 0$ …….. (1)

Equation outside the super node,

SN: $\frac{V1}{4} + \frac{V1-V3}{1} + \frac{V2}{1} = 1+2V_0$; Here , $V_0 = V_1-V_3$

⇨ $\frac{V1}{4} + V_1 - V_3 + V_2 = 1 + 2V_1 + 2V_3$

⇨ $\frac{V1}{4} - V_1 + V_2 + V_3 = 4$ …… (2)

Equation at node 3 ,

$\frac{V3-10}{2} + \frac{V3}{4} + \frac{V3-V1}{1} = -2V_0$

⇨ $\frac{V3}{2} - 5 + \frac{V3}{4} + V_3 - V_1 = -2V_1 + 2V_3$

⇨ $V_1 - V_3 + \frac{V3}{2} + \frac{V3}{4} = 5$

⇨ $4V_1 - 4V_3 + 2V_3 + V_3 = 20$

⇨ $4V_1 - V_3 = 20$ ……..(3)

By equating the equations we get ,

$V_1 = 4.96969$ V

$V_2 = 4.84848$ V

$V_3 = -0.12121$ V

Now, $V_0 = V_1 - V_3$

$V_0 = 4.96969 - (-0.12121)$ V

$V_0 = 5.0909$ V

And , $I_0 = \frac{V3}{4}$

$I_0 = \frac{-0.12121}{4}$ A

$I_0 = -0.303025$ A

$I_1 = \frac{V1}{4} = \frac{4.96969}{4} = 1.2424$ A

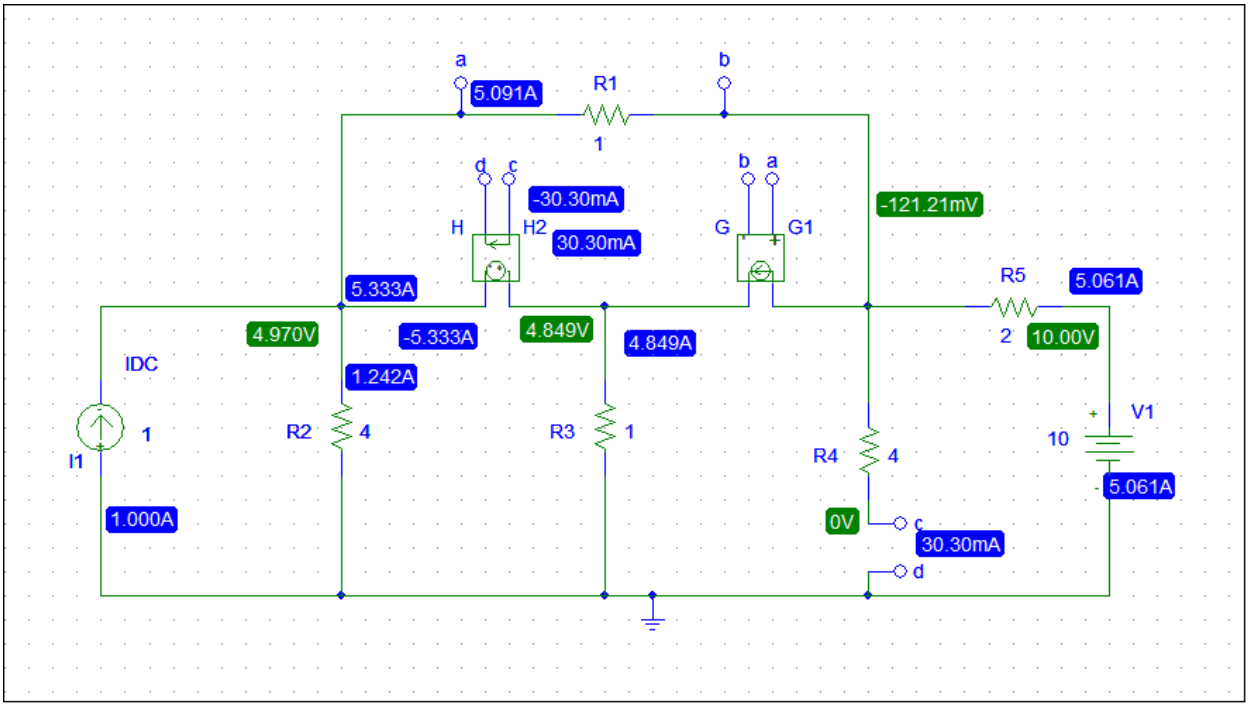
$I_2 = \frac{V2}{1} = 4.84848$ A

$I_3 = \frac{10 - V3}{2} = 5.0606$ A

$I_4 = \frac{V0}{1} = 5.0909$ A

$I_5 = 2V_0 - I_2 = (2 \times 5.0909) - 4.84848 = 5.333$ A

2.PSPICE Simulation



3.Comparison Table

Indications	Theoretical Values	Simulated Values	Differences
V_1	4.96969 V	4.970 V	0.00031
V_2	4.84848 V	4.849 V	0.00052
V_3	-0.12121 V	-0.12121 V	0
I_1	1.2424 A	1.242 A	0.0004
I_2	4.84848 A	4.849 A	0.00052
I_3	5.0606 A	5.061 A	0.0004
I_4	5.0909 A	5.091 A	0.0001
I_5	5.333 A	5.333 A	0
I_0	-0.303025 A	-0.3030 A	0.000025